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November 24, 2003

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APPLICATION NUMBER: *60/415,753*
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By Authority of the
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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

PTO/SB/16 (10-01)
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This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(b)(2)

INVENTOR(s)/APPLICANT(s)

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☐ Additional inventors are being named on the ___ separately numbered sheets attached hereto.

TITLE OF THE INVENTION (280 characters max)

DUAL OUTPUT ILLUMINATION SYSTEM USING DUAL PARABOLOID REFLECTOR SYSTEM

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ENCLOSED APPLICATION PARTS (check all that apply)

☒ Specification *Number of Pages* [2]
☒ Drawing(s) *Number of Sheets* [2]
☐ Application Data Sheet. See 37 CFR 1.76
☐ CD(s), Number _____
☐ Other *(specify)* _____

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT (check one)

☐ Applicant claims small entity status. See 37 CFR 1.27
☒ A check or money order is enclosed to cover the filing fee
☐ The Commissioner is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number: 02-2135
☐ Payment by credit card. Form PTO-2038 is attached.

Filing Fee Amount: $160.00

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No.
☐ Yes, the name of the U.S. Government agency and the Government contract number are: _____

Respectfully submitted,

SIGNATURE _____ Date 10-4-02

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REGISTRATION NO. 31,414
Docket Number 2138-274

USE ONLY FOR FILING PROVISIONAL APPLICATION FOR PATENT

Dual Output Illumination System using Dual Paraboloid Reflector System

Introduction

Dual paraboloid reflector has been used for efficient coupling of light onto a very small etendue target, for example, smaller imagers in projection displays, and single or multiple fiber optics. In particular for fiber optic illuminations to mimic neon light illumination with side-lit fibers, it is important that the angle of illumination be small so that the intensity profile along the length of the fiber be as uniform as possible. A single output illuminator with the dual paraboloid reflectors system provide efficient output at smaller angle of illumination such that the intensity along the fiber is sufficiently uniform. If the fiber is too long, the intensity will eventually drop to a point such that the uniformity will not be acceptable. If the fiber is too short, too much light will be wasted. One way to overcome these scenarios is to couple light into the fiber optic from both ends for a longer length of fiber such that light is not wasted and the uniformity along the length is acceptable. One simple way to implement such a system is to employ 2 illuminators, one at each end of the fiber. Another way is to use dual output illuminators such that the fibers can be daisy chained as shown in Figure 1. Fiber F2 is illuminated by illuminators L1 and L2 and fiber F3 is illuminated by illuminators L2 and L3. Many of the illuminators that provide the 2 outputs are done by bundling 2 fibers into the same output port of the illuminator. This tends to be inefficient due to the loss in packing the 2 fibers together. Another scheme is shown by the EFO system used in Fiberstars illuminators in which the light output from the lamp is coupled to 2 fibers using 2 separate reflector system. Although the loss of the system is smaller compared to bundling of the fibers, this system does not allow efficient coupling of light into small targets. The invention described by US Patent # 6,227,682 shows a dual paraboloid reflector system that can couple light efficiently into a small target, but does not produce 2 outputs.

Therefore, there exists a need for a system to couple light efficiently from a lamp into 2 fiber optic outputs with small etendues so that longer fibers can be illuminators with more uniform intensities.

Description of the Invention

Figure 2 shows the preferred embodiment of this invention. It consists of an arc lamp placed at the first focus of the first dual paraboloid (DP) reflector. The cross-section of the DP reflector is subtends substantially half of a circle. As a result, half of the light emitted by the lamp will be collected, collimated, and directed to the second focus where the tapered light pipe (TLP) is placed. Due to the symmetry of the DP reflector, the arc is imaged 1:1 with unit magnification from the arc to the entrance of the TLP, thus preserving the brightness of the arc. The tapered light pipe is made such that the output of the light pipe matches with the dimensions and the numerical aperture (NA) of the output fiber optic. A second DP reflector is placed opposite to the first DP reflector as shown in Figure 2. The other half of the light will be collected by the second DP

reflector and eventually focused onto the second TLP as described previously. This configuration, thus, provides 2 outputs from a single lamp and will be suitable for daisy chain in the fiber optic applications.

The lamp can be an arc lamp, metal halide lamp, mercury and high-pressure lamps, and filament lamps. The reflectors are usually coated with coating for visible applications where the IR and UV are transmitted through the reflector and will not be outputted to the fiber optic. The tapered light pipe can have a cross-section of circular, elliptical, square, rectangular, hexagonal, or in general, polygonal.

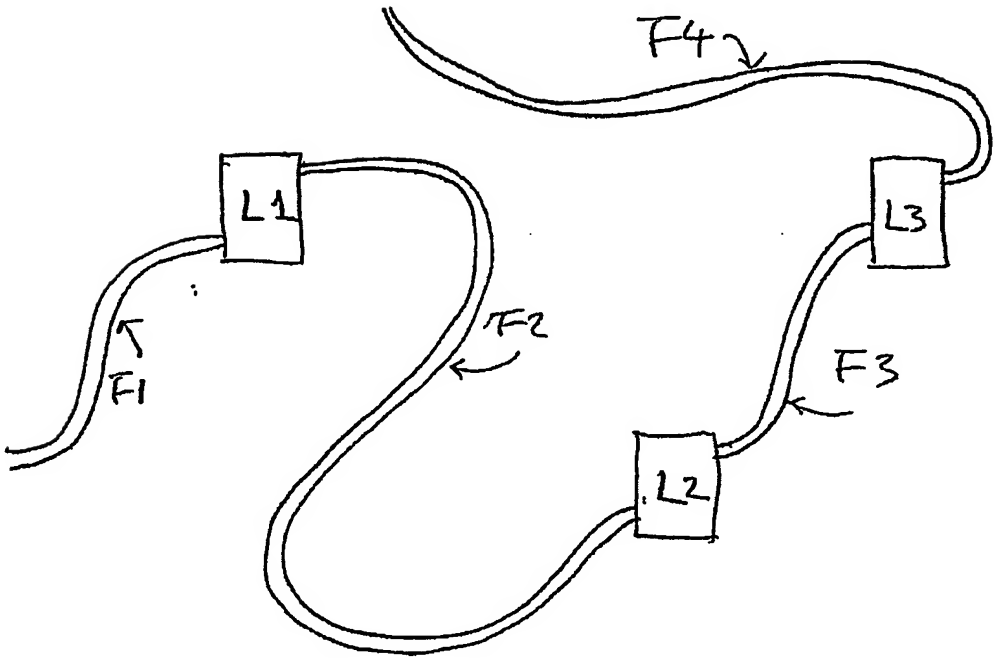

Figure 1

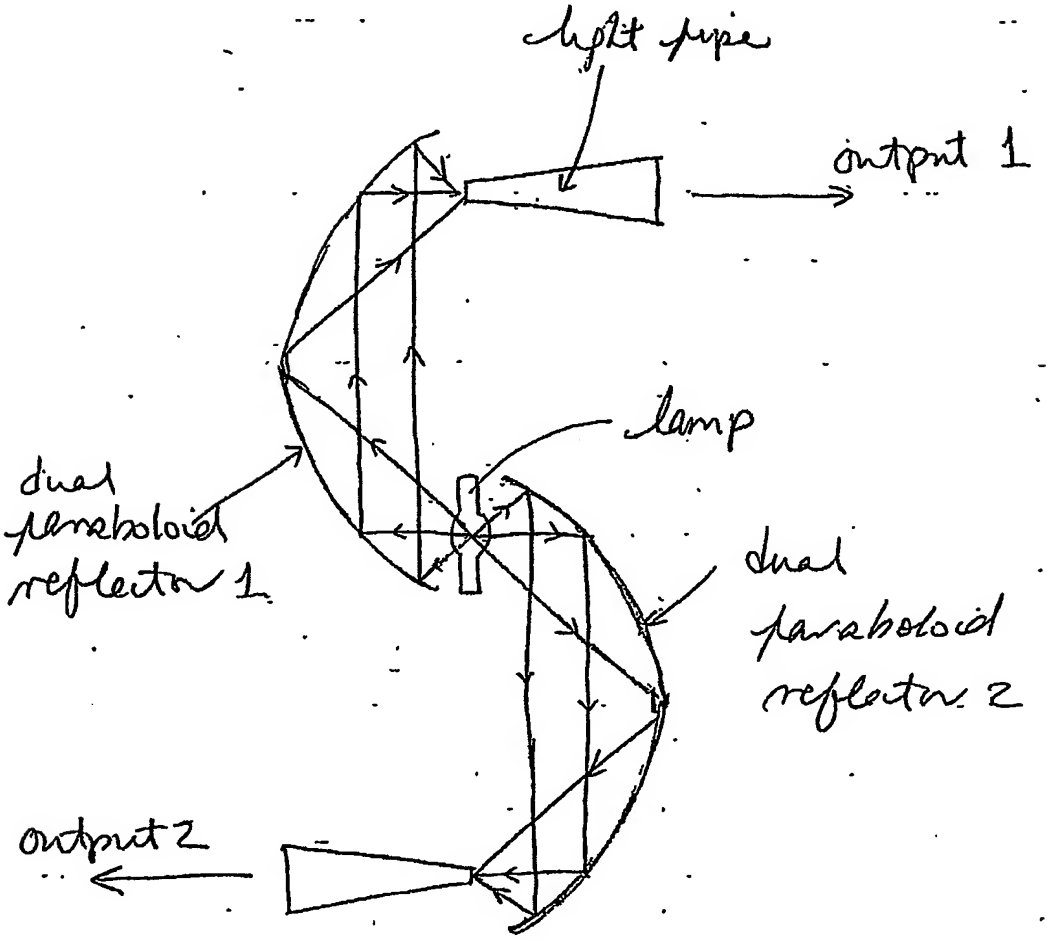

Figure 2